CLAIMS

1. A pulse wave measuring apparatus comprising:

a substrate (1) having pressure-sensing means (3) on a main surface; and

a protection member (12) having an accommodation space accommodating said substrate (1), the pulse wave measuring apparatus serving to measure a pulse wave by pressing said substrate (1) against a living body; wherein

a wall surface (20a) of said protection member (12) forming said accommodation space is arranged such that an air chamber (20) is interposed between said wall surface and an end surface of said substrate (1).

2. The pulse wave measuring apparatus according to claim 1, wherein said air chamber (20) is provided around an entire perimeter of said substrate (1).

3. The pulse wave measuring apparatus according to claim 1, wherein said air chamber (20) is open to atmosphere.

4. The pulse wave measuring apparatus according to claim 1, further comprising a circuit board (26) processing a signal, and a flexible line (18) transmitting a signal output from said pressure-sensing means (3) to said circuit board (26), wherein

said flexible line (18) includes a fixed portion (18a) fixed to said protection member (12), a connection portion (18b) connected to said substrate (1), and a loosened portion (18c) located between said fixed portion (18a) and said connection portion (18b).

5. The pulse wave measuring apparatus according to claim 4, wherein said loosened portion (18c) is located inside said air chamber (20).

6. The pulse wave measuring apparatus according to claim 1, further comprising a circuit board (26) processing a signal, and a flexible line (18) transmitting a signal output from said pressure-sensing means (3) to said circuit board (26), wherein

said flexible line (18) includes a fixed portion (18a) fixed to said protection member (12) and a connection portion (18b) connected to said substrate (1), and

a portion (18d) having rigidity different from that of another portion of said flexible line (18) is located between said fixed portion (18a) and said connection portion (18c) of said flexible line (18).

7. The pulse wave measuring apparatus according to claim 1, further comprising

a protection film (16) covering said main surface of said substrate (1) and said air chamber (20), and

attachment means (42) for fastening a peripheral portion of said protection film (16) to an outer circumferential wall of said protection member (12) for attachment.

8. The pulse wave measuring apparatus according to claim 7, wherein

said protection member (12) has a substantially circular outer shape when viewed from a direction orthogonal to said main surface of said substrate (1), and

said attachment means (42) is an O ring.

9. The pulse wave measuring apparatus according to claim 8, wherein

said outer circumferential wall of said protection member (12) has a concave fitting portion (47) fitting to an inner portion of said O ring (42) on an entire circumference, and

an outer portion of said O ring (42) projects from said outer circumferential wall of said protection member (12).

10. The pulse wave measuring apparatus according to claim 7, wherein said protection film (16) and said attachment means (42) are integrally formed.

11. The pulse wave measuring apparatus according to claim 7, wherein said protection film (16) has a collar portion (16a) in said peripheral portion.

12. The pulse wave measuring apparatus according to claim 1, wherein said protection member (12) includes an inner frame body (44) containing said accommodation space and an outer frame body (46) fitted to said inner frame body (44) so as to enclose an outer wall of said inner frame body (44),

said outer frame body (46) has a protection film portion (46d) covering said main surface of said substrate (1) and said air chamber (20), and

an outer circumferential wall of said outer frame body (46) has a projected portion (46c) on its entire circumference.

13. The pulse wave measuring apparatus according to claim 1, further comprising a circuit board (26) processing a signal, and a flexible line (18) transmitting a signal output from said pressure-sensing means (3) to said circuit board (26), wherein

said protection member (12) includes an inner frame body (44) containing said accommodation space and an outer frame body (46) fitted to said inner frame body (44) so as to enclose an outer wall of said inner frame body (44), and

said flexible line (18) is inserted between said inner frame body (44) and said outer frame body (46).

14. The pulse wave measuring apparatus according to claim 13, wherein said outer frame body (46) has an overhanging portion (46a) provided so as to project from an inner surface of said outer frame body (46) and facing, with a distance, a perimeter of an accommodation space forming surface of said inner frame body (44)

where said accommodation space is formed, and

said flexible line (18) inserted between said inner frame body (44) and said outer frame body (46) is protected by said overhanging portion (46a).

15. The pulse wave measuring apparatus according to claim 1, wherein said protection member (12) is formed with a conductive material.

16. The pulse wave measuring apparatus according to claim 15, wherein said protection member (12) is electrically connected to a ground potential.

17. The pulse wave measuring apparatus according to claim 16, further comprising a circuit board (26) processing a signal, and a flexible line (18) transmitting a signal output from said pressure-sensing means (3) to said circuit board (26), wherein

said protection member (12) is electrically connected to the ground potential by means of said flexible line (18).

18. The pulse wave measuring apparatus according to claim 1, wherein said protection member (12) is formed with a metal material or a ceramic material.

19. The pulse wave measuring apparatus according to claim 1, wherein said protection member (12) has a plurality of small irregularities on its surface.

20. A pulse wave measuring apparatus for measuring a pulse wave by pressing against a living body a substrate (1) having pressure-sensing means (3) on a main surface; wherein

said substrate (1) has a groove (4) around said pressure-sensing means (3).

21. The pulse wave measuring apparatus according to claim 20, further comprising a protection member (12) protecting said substrate (1), a circuit board (26) processing a signal, and a flexible line (18) transmitting a signal output from said pressure-sensing means (3) to said circuit board (26), wherein

said flexible line (18) includes a fixed portion (18a) fixed to said protection member (12), a connection portion (18b) connected to said substrate (1), and a loosened portion (18c) located between said fixed portion (18a) and said connection portion (18b).

22. The pulse wave measuring apparatus according to claim 20, further comprising a protection member (12) protecting said substrate (1), a circuit board (26) processing a signal, and a flexible line (18) transmitting a signal output from said pressure-sensing means (3) to said circuit board (26), wherein

said flexible line (18) includes a fixed portion (18a) fixed to said protection member (12) and a connection portion (18b) connected to said substrate (1), and

said flexible line (18) includes a portion (18d) having different rigidity between said fixed portion (18a) and said connection portion (18b).

23. A pulse wave measuring apparatus comprising:

a substrate (1) having pressure-sensing means (3) on a main surface;

a circuit board (26) processing a signal; and

a flexible line (18) transmitting a signal output from said pressure-sensing means (3) to said circuit board (26), the pulse wave measuring apparatus serving to measure a pulse wave by pressing said substrate (1) against a living body; wherein

said substrate (1) has a connection electrode portion (5a) connected to said flexible line (18), in a position lower than said main surface.

24. The pulse wave measuring apparatus according to claim 23, wherein

said substrate (1) has a stepped-down portion (6) on a main surface, and said stepped-down portion (6) has said connection electrode portion (5a) formed.

25. The pulse wave measuring apparatus according to claim 24, wherein an upper surface of said flexible line (18) located on a side opposite to said connection electrode portion (5a) on said stepped-down portion (6) and the main surface of said substrate (1) are located on an identical plane.

26. The pulse wave measuring apparatus according to claim 24, wherein a spacer member (22) is arranged on the upper surface of said flexible line (18), and

an upper surface of said spacer member (22) located on a side opposite to said flexible line (18) and the main surface of said substrate (1) are located on an identical plane.

27. The pulse wave measuring apparatus according to claim 23, wherein said connection electrode portion (5a) is formed on a back surface of said substrate.

28. The pulse wave measuring apparatus according to claim 23, further comprising a protection member (12) protecting said substrate (1), a circuit board (26) processing a signal, and a flexible line (18) transmitting a signal output from said pressure-sensing means (3) to said circuit board (26), wherein

said flexible line (18) includes a fixed portion (18a) fixed to said protection member (12), a connection portion (18b) connected to said substrate (1), and a loosened portion (18c) located between said fixed portion (18a) and said connection portion (18b).

29. The pulse wave measuring apparatus according to claim 23, further comprising a protection member (12) protecting said substrate (1), a circuit board (26) processing a signal, and a flexible line (18) transmitting a signal output from said pressure-sensing means (3) to said circuit board (26), wherein

said flexible line (18) includes a fixed portion (18a) fixed to said protection member (12) and a connection portion (18b) connected to said substrate (1), and

said flexible line (18) includes a portion (18d) having different rigidity between said fixed portion (18a) and said connection portion (18b).